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USSN 10/071,356

PATENT

–15 –

Remarks

Following this Amendment, claims 2-20, 22-28 and 30-33 are active in the application.

I. CLAIM REJECTIONS UNDER 35 USC § 102(b)

Claims 1-3, 6, 7, 9, 10, 21, and 29-31 are rejected under 35 USC § 102(b) as being anticipated by United States patent no. 6,181,846 of Pan. The applicant has cancelled claims 1, 21 and 29 and respectfully traverses the rejection of claims 2, 3, 6, 7, 9, 10, 30 and 31 on the grounds that none of claims 2, 3, 6, 7, 9, 10, 30 and 31 reads on Pan's device.

1. Claim 2

With reference to claim 2, the official action alleges that Pan's polarization-dependent optical-path device (15) includes an input polarization-dependent path splitting element, said input polarization-dependent path splitting element converting said input light polarization components that are at least partially spatially coincident into said spatially-separated input-light polarization components, thereby defining a branched input. The official action points to the dashed and solid lines of input light depicted in Figs. 3B & 3C.

The applicant respectfully traverses the rejection of claim 2 on the grounds that Pan does not disclose every element recited in claim 2 arranged as stated in the claim. Specifically, the applicant respectfully submits that Pan's device lacks an input polarization-dependent path splitting element that defines a branched input, as recited in claim 2. The applicant notes that Pan's birefringent element 15 converts input-light polarization components that are at least partially spatially coincident into spatially-separated input-light polarization components, as depicted in Figures 3B and 3C. However, the applicant respectfully submits that the conversion of input light polarization components that are at least partially spatially coincident into spatially-separated input-light polarization components, as performed by birefringent element 15, does not constitute polarization-

-16 -

Fax:6504855487

PATENT

dependent path splitting that might allow the birefringent element to be accurately described as an input polarization-dependent path splitting element that defines a branched input, as recited in claim 2. Contrast Pan's Figures 3B and 3C with Figure 2 of the application.

That Pan's optical device lacks an input polarization-dependent path splitting element that defines a branched input is evident from the number of input paths and output paths in Pan's optical device that are related in the sense that light can pass from one to the other. Pan's optical device has only a single input path provided by one of the two fibers 10 and 11. The other of the fibers 10 and 11 constitutes a single, non-branched output. Note that, even in the twochannel embodiment shown in Pan's Figure 7, each channel has only a single input path and a single output path between which light can pass. Light can pass between opposite fibers, but cannot pass between adjacent fibers in this embodiment. Thus, none of Pan's embodiments can accurately be said to have a branched input (or a branched output). Pan's Figure 7 embodiment will be discussed further below with reference to claims 4 and 11.

Accordingly, the applicant respectfully submits that, since Pan's optical device lacks an input polarization-dependent path splitting element path that defines a branched input as recited in claim 2, claim 2 is patentable.

2. Claim 3

With reference to claim 3, the official action alleges that the optical device taught by Pan further comprises an output polarization-dependent path splitting element (i.e., 16: see Figs. 3B & 3C) that defines a branched output.

The applicant respectfully traverses the rejection of claim 3 on the grounds that Pan does not disclose every element recited in claim 3 arranged as stated in the claim. Specifically, the applicant respectfully submits that Pan's device lacks an output polarization-dependent path splitting element that defines a branched output, as recited in claim 3.

-17 -

PATENT

Pan describes his element 16 as a GRIN lens (col. 2, line 60). GRIN lenses are typically polarization-independent devices. The applicant has been unable to find any teaching in Pan that would indicate that Pan's element 16 has polarization-dependent properties. Thus, it would be inaccurate to describe Pan's GRIN lens as being "polarization-dependent." Moreover, Pan describes his element 16 as collimating the polarization components output by birefringent crystal 15 (col. 3, lines 51-52). Pan's element 16 additionally images the polarization components reflected by reflector 19 at the birefringent crystal. The applicant respectfully submits that the focusing and imaging performed by Pan's GRIN lens 16 does not constitute polarization-dependent path splitting that might allow the GRIN lens to be accurately called an output polarization-dependent path splitting element that defines a branched output, as recited in claim 3. Contrast Pan's Figures 3B and 3C with Figure 2 of the application.

That Pan's optical device lacks a polarization-dependent path splitting element that defines a branched output is evident from the number of input paths and output paths in Pan's optical device that are related in the sense that light can pass from one to the other. Pan's optical device has only a single input path provided by one of the two fibers 10 and 11. The other of the fibers 10 and 11 constitutes a single, non-branched output. Note that, even in the two-channel embodiment shown in Pan's Figure 7, each channel has only a single input path and a single output path between which light can pass. Light can pass between opposite fibers, but cannot pass between adjacent fibers in this embodiment. Thus, none of Pan's embodiments can accurately be said to have a branched output (or a branched input).

Accordingly, the applicant respectfully submits that, since Pan's device lacks a polarization-dependent path splitting element as recited in claim 3, claim 3 is patentable.

PATENT

USSN 10/071,356

-18 -

3. Claims 6, 7, 9 and 10

The applicant respectfully submits that claims 6, 7, 9 and 10 are patentable because they depend on claim 2, which is patentable for the reason stated above.

4. Claims 29-31

With reference to claims 29-31, the official action alleges that the structural teachings of Pan set forth in the official action implicitly meet the method step limitations recited in these claims. The applicant has cancelled claim 29 and respectfully submits that claims 30 and 31 do not read on Pan's disclosure for reasons similar to those set forth above with reference to claims 2 and 3. Accordingly, the applicant respectfully submits that claims 30 and 31 are patentable.

II. CLAIM REJECTIONS UNDER 35 USC § 103(a)

A. Claims 4, 11-20 and 32

Claims 4, 11-20 and 32 are rejected under 35 USC § 103(a) as being unpatentable over United States patent no. 5,973,831, allegedly of Pan.

The applicant notes with respect that United States patent no. 5,973,831 is entitled Systems for Three-Dimensional Viewing Using Light Polarizing Layers and was issued to Kleinberger, not to Pan. The applicant will assume that claims 1, 11-20 and 32 are rejected over United States patent no. 6,181,846 of Pan.

The applicant respectfully traverses the rejection on the grounds that the official action does not set forth a proper prima facie case of obviousness with respect to claims 4, 11-20 and 32.

1. Claim 4

The official action states as follows:

Pan discloses, in Figs. 3B & 3C, the claimed invention as set forth above EXCEPT FOR an explicit teaching with respect to claim 4, wherein at least a portion of said output-light polarization components is out-coupled from the optical device through said branched input ... Pan, however, with respect to claim 4, additionally discloses an embodiment (depicted in Fig. 7) in which, after optical fibers 50-53

PATENT

-19 -

Fax:6504855487

have been respectively denominated, one with respect to the others or pairwise, as being branched input or output, at least a portion of said output-light polarization components is out-coupled from the optical device through said branched input. See col. 6, ll. 45-58. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the optical device of Pan depicted in Figs. 3B & 3C therein such that at least a portion of said output-light polarization components be out-coupled from the optical device through said branched input, as well as such that said optical device further comprise a second input port and a second output port, both being taught by Pan in the embodiment of said optical device depicted in Fig. 7 therein, for at least the purposes of increasing the functionality of said optical device by allowing said output-light polarization components to be out-coupled from said optical device through more than one optical fiber, as well as allowing more than one set of input-light polarization components to be incoupled to said device.

First, the applicant respectfully submits that the official action does not set forth a proper prima facie case of obviousness because claim 4 does not read on Pan's device modified as proposed in the official action. The applicant respectfully directs the Examiner's attention to Pan's Figure 3C, which shows that the polarization components are offset in opposite directions from the core of optical fiber 11 in the OFF state of Pan's device. Accordingly, the applicant respectfully submits that no location exists in Pan's device where one of Pan's additional optical fibers could be located to receive both polarization components in the OFF state of Pan's device, as would be required for Claim 4 to read on Pan's device modified as proposed in the official action.

Second, the applicant respectfully submits that the official action does not set forth a proper prima facie case of obviousness because the proposed modification of Pan's device is improper. The applicant notes that the official action does not indicate where in Pan's disclosure may be found a teaching that would provide a motivation for a person of ordinary skill in the art to modify Pan's optical device in the manner proposed in the official action. The applicant further notes that he has been unable to find such teaching in Pan's disclosure. Moreover, the applicant has been unable to find any teaching in Pan's disclosure of the desirability of out-coupling the output polarization components through more than one optical fiber, even in the description of Pan's Figure 7 embodiment, which has more than a single input fiber and a single output fiber. Accordingly,

-20 -

PATENT

the applicant respectfully submits that the motivation set forth in the official action is the result of hindsight based on the applicant's disclosure, and is therefore improper.

Fax:6504855487

Moreover, the applicant notes that Pan discloses an embodiment with four optical fiber cores as shown in Figures 7, 8A and 8B. However, Pan explicitly teaches that pairs of the optical fiber cores operate independently, see, e.g., col. 6, lines 40-58. Pan's Figure 7 embodiment is simply two, independent optical switches/attenuators that use a common birefringent element, a common GRIN lens and a common liquid crystal element. Pan teaches "light can travel between the fibers 50 and 51, and between the fibers 52 and 53 when the liquid crystal cell 68 is in the On state. When the liquid crystal cell 68 is Off, no light travels between any of the optical fibers." The applicant respectfully submits that this portion of Pan's disclosure teaches away from out-coupling the output polarization components through more than one optical fiber and that the proposed modification of Pan's device is improper for this additional reason. Accordingly, the applicant respectfully submits that claim 4 is patentable.

2. Claim 11

The official action states as follows:

Pan discloses, in Figs. 3B & 3C, the claimed invention as set forth above EXCEPT FOR ... an explicit teaching with respect to claim 11, wherein said polarization-dependent optical-path device has at least a second input port and a second output port [in addition, of course, to the disclosed first input port (10) and the first output port (11)]. Pan, however, ... with respect to claim 11, Pan explicitly teaches a second input port and a second output port (it being noted as being arbitrary which of ports 50-53 are to be so designated). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the optical device of Pan depicted in Figs. 3B & 3C therein such that at least a portion of said output-light polarization components be out-coupled from the optical device through said branched input, as well as such that said optical device further comprise a second input port and a second output port, both being taught by Pan in the embodiment of said optical device depicted in Fig. 7 therein, for at least the purposes of increasing the functionality of said optical device by allowing said output-light polarization components to be out-coupled from said optical device through more than one optical fiber, as well as allowing more than one set of input-light polarization components to be incoupled to said device.

PATENT

 $-21 - \cdot$

Fax:6504855487

First, the applicant respectfully submits that the official action does not set forth a proper prima facie case of obviousness because claim 11 does not read on Pan's device modified as proposed in the official action. The applicant respectfully directs the Examiner's attention to Pan's Figure 3C, which shows that the polarization components are offset in opposite directions from the core of optical fiber 11 in the OFF state of Pan's device. Accordingly, the applicant respectfully submits that no location exists in Pan's device where one of Pan's additional optical fibers could be located to receive both polarization components in the OFF state of Pan's device, as would be required for Claim 11 to read on Pan's device modified as proposed in the official action.

Second, the applicant respectfully submits that the official action does not set forth a proper prima facie case of obviousness because the proposed modification of Pan's device is improper. The applicant notes that the official action does not indicate where in Pan's disclosure may be found a teaching that would provide a motivation for a person of ordinary skill in the art to modify Pan's optical device in the manner proposed in the official action. The applicant further notes that he has been unable to find such teaching in Pan's disclosure. Moreover, the applicant has been unable to find any teaching in Pan's disclosure of the desirability of out-coupling the output polarization components through more than one optical fiber, even in the description of Pan's Figure 7 embodiment, which has more than a single input fiber and a single output fiber. Accordingly, the applicant respectfully submits that the motivation set forth in the official action is the result of hindsight based on the applicant's disclosure and is therefore improper.

Moreover, the applicant notes that Pan discloses an embodiment with four optical fiber cores as shown in Figures 7, 8A and 8B. However, Pan explicitly teaches that pairs of the optical fiber cores operate independently, see, e.g., col. 6, lines 40-58. Pan's Figure 7 embodiment is simply two, independent optical switches/attenuators that use a common birefringent element, a common GRIN lens and a common liquid crystal element. Pan teaches "light can travel between

Fax: 6504855487

USSN 10/071,356

PATENT

-22 -

the fibers 50 and 51, and between the fibers 52 and 53 when the liquid crystal cell 68 is in the On state. When the liquid crystal cell 68 is Off, no light travels between any of the optical fibers." The applicant respectfully submits that this portion of Pan's disclosure teaches away from out-coupling the output polarization components through more than one optical fiber and that the proposed modification of Pan's device is improper for this additional reason. Accordingly, the applicant respectfully submits that claim 11 is patentable.

3. Claims 12-20 & 32

With reference to claims 12-20 and 32, the official action states:

it is submitted that—once account is taken of the various permutations of operation (express or implied) of the embodiment of the optical device depicted in Fig. 7 of Pan—the disclosures of Pan encompass the limitations recited in each of these claims

The applicant respectfully submits that the rejection of claims 12-20 and 32 is improper because the official action does not establish a *prima facie* case of obviousness with respect to these claims. The official action does not set forth a rationale indicating the manner in which each of claims 12-20 and 32 reads on Pan's disclosure modified as proposed in the official action. Nor does the official action indicate where may be found in Pan's disclosure a teaching that would provide a motivation for the person of ordinary skill in the art to modify Pan's device in the manner proposed in the official action. Accordingly, the applicant respectfully submits that claims 12-20 and 32 are patentable.

B. Claims 5, 8, and 33

Claims 5, 8, and 33 are rejected under 35 USC § 103(a) as being unpatentable over United States patent no. 5,973,831, allegedly of Pan, in view of United States patent no. 4,799,768 of Gahan. The applicant notes with respect that United States patent no. 5,973,831 is entitled Systems for Three-Dimensional Viewing Using Light Polarizing Layers and was issued to Kleinberger, not to Pan. The applicant will assume that claims 5, 8 and 33 are rejected over United States

-23 -

PATENT

patent no. 6,181,846 of Pan in view of United States patent no. 4,799,768 of Gahan.

The applicant respectfully traverses the rejection on the grounds that the official action does not set forth a proper *prima facie* case of obviousness with respect to claims 5, 8 and 33.

The official action states:

Pan discloses (in Fig., 7) the optical device as set forth above EXCEPT FOR wherein, with respect to claims 5 & 33, said plurality of states constitutes a continuum of states such that said optical device functions as an analog optical device, and wherein the respective portions of ourput-light polarization components that are out-coupled from the optical device through said branched input and through said branched output is controllably variable over a continuum of said portions by selecting the state of the reflector from said continuum of states; and wherein, with respect to claim 8, when said reflector is in a third one of said plurality of states, the optical device functions as a beam splitter.

Gahan, however, provides an explicit teaching a reflector (18) having a plurality of states, said plurality of states constituting, inter alia, a continuum of states (col. 3, ll. 11-13). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the reflector of Pan, already taught therein as having a plurality (read: two or more) of states, such that said plurality of states constitute a continuum of states, thereby functioning as an analog device (inherent), as explicitly taught by Gahan, for at least the purpose of enabling said optical device to output said output light polarization components in a more variable manner than would be the case if said plurality of states of said reflector were limited to "on" and "off" states. And with respect to claim 8, it is submitted that in one of said plurality of states of said reflector in the combination that said optical device depicted in Fig. 7 of Pan would function as a beam splitter in the manner as that set forth in this claim.

First, the applicant respectfully submits that the official action does not set forth a proper *prima facie* case of obviousness because none of claims 5, 8 and 33 reads on Pan's device modified as proposed in the official action. Gaban discloses a variable-reflectivity rear-view mirror for use in automobiles. The cited passage of Gahan's disclosure teaches that the mirror has reflective states that can be discretely or continuously varied. Claim 2 on which claims 5 and 8 depend recites "said reflector having a plurality of states, and being controllable such that said reflector can be changed from one of said plurality of states to another of said plurality of states, said reflected angles of polarization having an orientation relative to said incident angles of polarization, said orientation being a function of the state of the reflector." The applicant has been unable to find anything in

-24 -

PATENT

Gahan's disclosure that teaches or suggests that the reflective states of Gahan's disclosure are ones on which the orientation of a reflected angle of polarization depends. Accordingly, the applicant respectfully submits none of claims 5, 8 and 33 reads on Pan's device modified as proposed in the official action.

Second, the applicant respectfully submits that the official action does not set forth a proper *prima facie* case of obviousness because the proposed modification of Pan's device is improper. The applicant notes that the official action does not indicate where in the cited references may be found a teaching that would provide a motivation for the person of ordinary skill in the art to modify Pan's optical device in the manner proposed in the official action. The applicant further notes that he has been unable to find such teaching in the cited references. Accordingly, the applicant respectfully submits that the motivation set forth in the official action is the result of hindsight based on the applicant's disclosure, and is therefore improper.

Moreover, the applicant notes that Pan teaches that his mirror element 19 is "highly reflective" (col. 2, line 66). The applicant respectfully submits that the proposed modification of Pan's device is improper because it would render Pan's device inoperable for its stated purpose. A reflector with multiple states of reflectivity would not comply with Pan's description of such element being "highly reflective," at least in some of its states.

Finally, the applicant respectfully submits that Gahan is not analogous prior art, and hence, is not a valid reference with respect to the present invention. Gahan is directed to a rear-view mirror for automotive applications. The applicant's invention is directed to a microminiature optical switch or attenuator. It should be noted that Pan, which is analogous prior art, and Gahan are in different classifications and had entirely different fields of search during their prosecution.

Accordingly, the applicant respectfully submits that claims 5, 8 and 33 are patentable.

-25 -

PATENT

C. Claims 22-28

Claims 22-28 are rejected under 35 USC § 103(a) as being unpatentable over United States patent no. 5,930,422 of Cheng in view of United States patent no. 5,973,831 allegedly of Pan. The applicant will assume that claims 22-28 are rejected over United States patent no. 5,930,422 of Cheng in view of United States patent no. 6,181,846 of Pan.

The applicant respectfully traverses the rejection on the grounds that the official action does not set forth a proper *prima facie* case of obviousness with respect to claims 22-28.

1. Claim 22

With regard to claim 22, the official action states:

Cheng discloses the invention as claimed-[a]n integrated optical device (see Fig. 4) comprising: at least a first input port (P1 or P2); at least a first output port (P2 or P3); a substantially nonreciprocal direction stage (14 & 16) comprising one or more elements, the directional stage receiving light from at least the first input port (see Fig. 4), the received light having polarization components (see polarization components walked-off by walk-off crystal 16), the directional stage controlling a path of propagation of the received light through the directional stage by operating on the polarization components of the received light (see above & Fig. 4); a reflective element (20); and a polarization stage (18) interposed between the directional stage and the reflective element, the polarization stage directing the polarization components of light propagating through the directional stage onto the reflective element by operating on the polarization components of the light received by the polarization from the directional stage (the operation being focusing in this instance)-EXCEPT FOR disclosure of the following additionally recited limitations: wherein said reflective element has a plurality of states such that light impinging on the reflective element is reflected by the reflective element with a polarization that depends on the state of the reflective element, and wherein said polarization stage directs light components reflected from the reflective element into the directional stage with a polarization that depends on the state of the reflective element to enable the directional stage to control the path of propagation of the reflected light based on the polarization of the reflected light components (it being noted that modifying the optical device of Cheng such that its reflective element have a plurality of states such that light impinging on the reflective element is reflected by the reflective element with a polarization that depends on the state of the reflective element would necessarily, in light of the arrangement of the elements comprising the optical device of Cheng, enable said directional stage to control the path of propagation of the reflected light based on the polarization of the reflected light components).

Pan, however, provides an explicit teaching of a reflective element (18 & 19 in Figs. 3B & 3C) that has a plurality of states such that light impinging on the reflective element is reflected by the reflective element with a polarization that

-26 -

PATENT

depends on the state of the reflective element (col. 3, Il. 11-26). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the optical device of Cheng such that its reflective element have a plurality of states such that light impinging on the reflective element be reflected by the reflective element with a polarization that depends on the state of the reflective element, as taught by Pan, for at least the purpose of providing increased directional control of said polarization components of light propagating through said optical device.

First, the applicant respectfully submits that the official action does not set forth a proper prima facie case of obviousness with respect to claim 22 because claim 22 does not read on Chang's device modified as proposed in the official action. The applicant respectfully submits that Chang's device lacks an element that can accurately be described as "a polarization stage interposed between the directional stage and the reflective element, the polarization stage directing the polarization components of light propagating through the directional stage onto the reflective element by operating on the polarization components of the light received by the polarization stage from the directional stage, and wherein the polarization stage directs light components reflected from the reflective element into the directional stage with a polarization that depends on the state of the reflective element to enable the directional stage to control the path of propagation of the reflected light based on the polarization of the reflected light components", as recited in claim 22. The official action alleges that Chang's element 18 constitutes such polarization stage. However, Chang discloses that his element 18 is a lens, specifically a GRIN lens (col. 5, lines 16 and 17). The applicant respectfully submits that a GRIN lens has none of the above-quoted properties of the polarization device. Moreover, the applicant has been unable to find any teaching in Chang's disclosure that would indicate that Chang's element 18 has such properties. Accordingly, the applicant respectfully submits that, since Chang's device modified as proposed in the official action lacks an element that can accurately be described the polarization device recited in claim 22, claim 22 does not read on Chang's device modified as proposed in the official action. The applicant therefore respectfully submits that the rejection of claim 22 is improper.

-27 -

PATENT

Second, the applicant respectfully submits that the official action does not set forth a proper prima facie case of obviousness because the proposed modification of Chang's device is improper. The applicant notes that the official action does not indicate where in the cited references may be found a teaching that would provide a motivation for the person of ordinary skill in the art to modify Chang's optical device in the manner proposed in the official action. The applicant further notes that he has been unable to find such teaching in the cited references. Accordingly, the applicant respectfully submits that the motivation set forth in the official action is the result of hindsight based on the applicant's disclosure and is therefore improper.

Moreover, the applicant notes that Chang discloses an optical circulator. The applicant respectfully submits that the proposed modification of Chang's device would render Chang's optical circulator inoperable for its stated purpose. This is because, in some states of a reflective element with a plurality of states, the modified device would not transfer light from one port to the next, and would therefore fail to function as an optical circulator. The applicant respectfully submits that the proposed modification of Chang's device is improper for this additional reason.

Accordingly, the applicant respectfully submits that claim 22 is patentable.

2. Claims 23-25

With regard to claims 23-25, the official action states:

[O]nce account is taken of the fact that both a first one and a second one of said plurality of states of said reflective element can be a non-off state, the optical device of combination meets the limitations recited in these claims. See above and Fig. 4 of Cheng (the designation of ports as being first input, second input, etc., being arbitrary).

The applicant respectfully submits that the rejection of claims 23-25 is improper because the official action does not establish a *prima facie* case of obviousness with respect to these claims. The official action does not set forth a rationale indicating the manner in which claims 23-25 read on Chang's device

-28 -

PATENT

modified as proposed in the official action. Nor does the official action indicate where may be found in the cited reference a teaching that would provide a motivation for the person of ordinary skill in the art to modify Chang's device in the manner proposed in the official action.

Accordingly, the applicant respectfully submits that claims 23-25 are patentable.

3. Claims 26 and 28

The applicant respectfully submits that claims 26 and 28 are patentable because they depend on claim 22, which is patentable for the reasons set forth above.

4. Claim 27

With reference to claim 27, the official action states that the polarization stage of the combination comprises a birefringent element (18). The applicant respectfully disagrees. As noted above, Chang describes his element 18 as a lens, preferably a GRIN lens. The applicants have been unable to find any indication in Chang's disclosure of element 18 having birefringent properties.

Accordingly, the applicant respectfully submits that claim 27 is patentable because claim 27 does not read on Chang's device modified as proposed in the official action and because the proposed modification of Chang's device is improper.

The applicant respectfully requests reconsideration of the rejected claims. The applicant believes that the application as now amended is in condition for allowance, and respectfully requests such favorable action. If any matters remain outstanding in the application, the Examiner is respectfully invited to telephone the applicant's attorney at (650) 485-3015 so that these matters may be resolved.

PATENT

-29 **-**

Respectfully submitted,

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